cleaning the pod thereby potentially retaining chemicals and particulates from the runoff cleaning solution.

What is needed is a reticle containment system that provides maximum protection for the reticle from particles and contamination by providing stable and secure support and a controlled environment. This should include a reticle pressure equalization system that effectively equalizes pressure between an internal controlled environment of the carrier and the air external to the carrier without incursion or excursion of air from the controlled environment and with minimal turbulence of the air already present within the controlled environment. What is also needed is a sealing system that does not utilize any form of a particulate generating material.

Summary of the Invention

A reticle pod having a base or door cooperating with a cover to form an enclosure for containing a reticle is disclosed. The pod having reticle protection means including reticle positioning and support means and environmental control means. The reticle positioning and support means facilitating and forming part of the environmental control means.

According to a first aspect, there is provided a dual containment pod for reticles comprising an inner pod and an outer pod, the inner pod comprising a base and an inner pod cover that cooperates with said base, the inner pod having a reticle seating position therein, the outer pod comprising an outer pod cover and a door cooperating with the outer pod cover, the outer pod sized for receiving the inner pod, and wherein the inner pod cover comprises a plurality of vertically moveable members positioned in the inner pod cover, the plurality of vertically movable members movable downwardly with respect to the inner pod cover for engaging the reticle, said plurality of vertically movable members are actuated by the engagement of said plurality of vertically movable members with the outer pod and move downwardly with respect to the inner pod cover as the inner pod is enclosed in the outer pod to engage the reticle.

According to a second aspect, there is provided a container for holding reticles, the reticle having a periphery, a top surface, a bottom surface, a side surface, four peripheral corners, a top edge and a bottom edge, the container comprising: a base having a periphery, four sides, each with side surfaces, positioned at the periphery, a top upwardly facing planar horizontal surface, the top upwardly facing planar horizontal surface traversing between the four sides and extending to the four side surface, with each of the four side extending downwardly from the top upwardly facing planar horizontal surface, the top upwardly facing planar horizontal surface having a plurality of reticle contact elements extending upwardly, the contact elements for engaging the reticle and defining a reticle seating position whereby the reticle is seated close enough to the top upwardly facing planar horizontal surface so as to provide a diffusion barrier for precluding particles from reaching a reticle face of the reticle facing the top upwardly facing planar horizontal surface, the top upwardly facing planar horizontal surface further having a sealing surface extending around the base at or proximate to the periphery of said base, the top upwardly facing horizontal surface extending from the sealing surface to under the reticle seating position and being coextensive therewith; a cover for engaging the top upwardly facing horizontal surface of the base along the base periphery, thereby defining an interior for holding the reticle, the cover having a downwardly facing horizontal planar sealing surface for cooperating with the sealing surface of the top upwardly facing planar horizontal surface of the base to create a seal therebetween when said respective surfaces are in contact, and wherein the cover comprises a plurality of reticle engagement members positioned in the cover to engage the reticle.

According to a third aspect, there is provided a container for holding reticles, the reticle having a periphery, a top surface, a bottom surface, a side surface, four peripheral corners, a top edge and a bottom edge, the container comprising: a base having a periphery, and a top upwardly facing horizontal surface with a plurality of contact elements for engaging the reticle, the base having a reticle seating position, the base further having a sealing surface extending around the base at or proximate to the periphery of said base; a cover for engaging the base along the base periphery, thereby defining an interior for holding the reticle, the cover having a sealing surface for cooperating with the sealing surface of the base to create a seal therebetween, the cover further comprising a vertically movable member positioned in an opening extending through the cover, the vertically movable member actuatable from exterior the cover to move the entire vertically movable member vertically relative to the cover for engaging the reticle in the container at the reticle seating position, the container further comprising an outer cover and a door receivable within the outer cover to define an additional container with an interior, the outer cover and door sized to receive the container for holding reticles in the interior.

In one embodiment, the subject reticle is generally rectangular, may have a patterned surface, and is positioned on a support structure mounted to a base or the door of the pod utilizing a plurality of positioning spherical balls or defining the position of the reticle on the base or door. The reticle can be positioned to a seating position by spherical balls or bevel surfaces located proximate the corners of the pod base or door and configured to position the reticle by tangentially contacting the reticle edges proximate the corners of the reticle. Locating the reticle with minimal contact area serves to reduce internal particle generation. Embodiments of the invention may also include reticle retainers mounted to the cover. The retainers may be spherical balls, which contact the reticle surface at a point. In other embodiments, the tangential point contact at the corners may be made by structures other than the spherical balls.

According to an embodiment of the invention, the reticle is located and secured within the SMIF reticle pod container by securing the reticle between two sets of projections that impart a rounded point contact on the reticle. In one embodiment, the

What is claimed is:

1. A container for holding reticles, the reticle having a periphery, a top surface, a bottom surface, a side surface, four peripheral corners, a top edge and a bottom edge, the container comprising:

a base having a periphery, and a top upwardly facing horizontal surface with a plurality of contact elements extending upwardly, the contact elements having a rounded top surface for engaging the reticle on the bottom surface, the base plate further having a plurality of posts positioned to constrain the periphery of the reticle, the top surfaces of the contact elements and the plurality of posts defining a reticle seating position, the upwardly facing horizontal surface further having a sealing surface extending around the base at or proximate to the periphery of said base;

a cover for engaging the top surface of the base plate along the base plate periphery, thereby defining an interior for holding the reticle, the cover having a downwardly facing horizontal planar sealing surface for cooperating with the sealing surface of the top upwardly facing horizontal surface of the base to create a seal therebetween when said respective surfaces are in contact.

2. The container of claim 1 wherein the base plate is formed at least primarily of metal at the and wherein the top surface is continuously planar and integral from the sealing surface to below the reticle seating position of the reticle.

3. The container of claim 2 wherein the downwardly facing horizontal planar sealing surface is formed of metal whereby there seal between the base and cover is metal to metal.

4. The container of claim 1 wherein the posts are formed of metal and have a top portion with a bevel slanted toward the reticle seating position.

5. The container of claim 1 wherein the posts have a vertical portion that is laterally adjacent the side surface of the reticle when the reticle is seated in the reticle seating position.

6. The container of claim 1 wherein the bevel of each of the plurality of posts defines the reticle seating position whereby the reticle seats on said bevel portions.

7. The container of claim 1 wherein each of the plurality of contact elements comprises a sphere.

8. The container of claim 7 where in the sphere is press fit downwardly into a recess or hole extending downwardly from the top upwardly facing horizontal surface.

9. The container of claim 7 wherein the bottom plate has a plurality of holes from the bottom side of the bottom plate for receiving the spheres each sphere is held therein by set screws.

10. The container system comprising the container of claim 1 and further comprising an outer cover and a door receiveable within the outer cover to define an interior, the outer cover and outer base sized to receive the container of claim 1.

11. The container of claim 1 wherein the cover comprises a plurality of vertically moveable reticle posts slidably positioned in the cover, the posts positioned to engage the top edge of the reticle.

12. The container of claim 11 wherein the each of the moveable reticle posts are resiliently positioned in the cover.

13. The container of claim 12 wherein each of the moveable reticle posts has a beveled portion to engage the upper edge of the reticle to urge and constrain the reticle into the reticle seating position.

14. The container of claim 1 further comprising a plurality of members attached to the container and moveable laterally, each member biased inwardly for constraining the reticle in position.

15. The container of claim 1 further comprising a filter for pressure equalization, the filter not having filter media and having a pair of confronting planar surfaces separated by a gap providing a diffusion barrier, the filter providing a pathway from the interior of the container to the exterior of the container.

16. The container of claim 15 wherein the gap is .001 to .007 inches thick.

17. The container of claim 15 wherein the pathway is tortuous having a plurality of corners and path segments.

18. The container of claim 15 wherein the pair of confronting surfaces are fixed to one another and are located on the top surface of the top cover.

19. The container of claim 15 wherein one of the pair of confronting surfaces is part of the top cover and the other is part of the base and wherein the filter is only operative when the top cover is seated on the base.

20. The container of claim 15 further comprising an addition container comprising an additional container top portion and an additional container door receivable and latchable to said top portion, the additional container sized to receive the container of claim 15, whereby said container of claim 15 is an inner container.

21. The container of claim 20 wherein the additional container top portion includes a plurality of resilient members extending downwardly on an inside surface of said top portion, and wherein said resilient members engage the top cover of the inner container.

22. The container of claim 21 wherein the top cover of the inner container comprises a plurality of vertically moveable reticle posts slidably positioned in the cover, the posts positioned to engage the top edge of the reticle, and wherein the resilient members engage said vertically moveable posts.

23. A container for holding reticles, the reticle having a periphery, a top surface, a bottom surface, a side surface, four peripheral corners, a top edge and a bottom edge, the container comprising:

a base having a periphery, and a top upwardly facing horizontal surface with a plurality of spheres disposed in the base, each of the spheres positioned primarily below the upwardly facing horizontal surface, the contact elements defining a reticle seating position, the base having an upwardly facing sealing surface at or proximate the periphery of the base;

a cover for engaging the top surface of the base plate along the base plate periphery, thereby defining an interior for holding the reticle, the cover having a downwardly facing sealing surface for cooperating with the sealing surface of the top upwardly facing horizontal surface of the base to create a seal therebetween when said respective surfaces are in contact.

24. The container of claim 23 wherein the sealing surface of the base and the sealing surface of the cover are both metal wherein a metal to metal seal is formed when the respective surfaces are engaged.

25. The container of claim 24 wherein the top cover is primarily formed of a polymer and the sealing surface of the top cover is part of a metal ring secured to said polymer.

26. The container of claim 23 wherein the base has a plurality of posts fixed into the base positioned adjacent the reticle seating position.

27. A container for holding reticles in combination with a reticle, the reticle having a periphery, a top surface, a bottom surface, a side surface, four peripheral corners, a top edge and a bottom edge, the container comprising:

a base having a periphery, and a top upwardly facing horizontal surface with a plurality of spheres disposed in the base, each of the spheres positioned primarily below the upwardly facing horizontal surface and extending above the surface a distance of .002 to .007 inches, the contact elements defining a reticle seating position, the base having an upwardly facing sealing surface at or proximate the periphery of the base;

a cover for engaging the top surface of the base plate along the base plate periphery, thereby defining an interior for holding the reticle, the cover having a downwardly facing sealing surface for cooperating with the sealing surface of the top upwardly facing horizontal surface of the base to create a seal therebetween when said respective surfaces are in contact.

28. The combination of claim 27 wherein the sealing surface of the base and the sealing surface of the cover are both non-elastomeric.

29. A dual containment pod for reticles comprising an inner pod and an outer pod, the inner pod comprising a base and a cover that cooperates with said base, the inner pod having a reticle seating position therein, the outer pod comprising a container portion and a base cooperating with the container portion, the outer pod sized for receiving the inner pod.

30. The dual containment pod of claim 29 further comprising a pressure equalization means that does not have filter media.

31. The dual containment pod of claim 29 wherein the pressure equalization means comprises a diffusion filter having a tortuous pathway.

32. The dual containment pod of claim 29 wherein the reticle is positioned close enough to the top surface of the base of the inner pod to provide a diffusion barrier to preclude particles from reaching a reticle face facing the top surface of the base.

33. The dual containment pod of claim 32 wherein the base of the inner pod comprises a plurality of spheres upon which the reticle seats, each sphere primarily positioned below the top surface of said base.

34. The dual containment pod of claim 32 wherein the spheres are comprised of polyamide-imide.

35. The dual containment pod of claim 29 wherein the spheres or rotatably mounted in the base.

36. The dual containment pod of claim 29 wherein the top cover of the inner pod comprises a plurality of vertically moveable reticle posts slidably positioned in the cover, the posts positioned to engage the top edge of the reticle

37. The dual containment pod of claim 35 wherein the top portion of the outer pod comprises a plurality of members positioned to engage the vertically moveable reticle posts when the inner pod is seated in the outer pod with the top portion of the outer pod engaging the door.

38. The dual containment pod of claim 29 wherein the vertically moveable posts are resiliently mounted to the top cover with a bias toward the reticle when the posts are displaced from their normal position.

39. A reticle container comprising a base and a top cover, the base having a plurality of reticle engagement members for supporting the reticle, the reticle engagement member comprised of polyamide-imide.

40. The reticle container of claim 39 wherein each reticle engagement member is configured as a sphere positioned in the top cover with a portion of the sphere below a top surface of the base.

CLAIMS

1. A dual containment pod for reticles comprising an inner pod and an outer pod, the inner pod comprising a base and an inner pod cover that cooperates with said base, the inner pod having a reticle seating position therein, the outer pod comprising an outer pod cover and a door cooperating with the outer pod cover, the outer pod sized for receiving the inner pod, and wherein the inner pod cover comprises a plurality of vertically moveable members positioned in the inner pod cover, the plurality of vertically movable members movable downwardly with respect to the inner pod cover for engaging the reticle, said plurality of vertically movable members are actuated by the engagement of said plurality of vertically movable members with the outer pod and move downwardly with respect to the inner pod cover as the inner pod is enclosed in the outer pod to engage the reticle.

2. A container for holding reticles, the reticle having a periphery, a top surface, a bottom surface, a side surface, four peripheral corners, a top edge and a bottom edge, the container comprising:

a base having a periphery, four sides, each with side surfaces, positioned at the periphery, a top upwardly facing planar horizontal surface, the top upwardly facing planar horizontal surface traversing between the four sides and extending to the four side surface, with each of the four side extending downwardly from the top upwardly facing planar horizontal surface, the top upwardly facing planar horizontal surface having a plurality of reticle contact elements extending upwardly, the contact elements for engaging the reticle and defining a reticle seating position whereby the reticle is seated close enough to the top upwardly facing planar horizontal surface so as to provide a diffusion barrier for precluding particles from reaching a reticle face of the reticle facing the top upwardly facing planar horizontal surface, the top upwardly facing planar horizontal surface further having a sealing surface extending around the base at or proximate to the periphery of said base, the top upwardly facing horizontal surface extending from the sealing surface to under the reticle seating position and being coextensive therewith;

a cover for engaging the top upwardly facing horizontal surface of the base along the base periphery, thereby defining an interior for holding the reticle, the cover having a downwardly facing horizontal planar sealing surface for cooperating with the sealing surface of the top upwardly facing planar horizontal surface of the base to create a seal therebetween when said respective surfaces are in contact, and wherein the cover comprises a plurality of reticle engagement members positioned in the cover to engage the reticle.

3. The container of claim 1 wherein, each of the reticle engagement members of the cover are movable and have a beveled portion to engage the upper edge of the reticle to urge and constrain the reticle into the reticle seating position.

4. A container for holding reticles, the reticle having a periphery, a top surface, a bottom surface, a side surface, four peripheral corners, a top edge and a bottom edge, the container comprising:

a base having a periphery, and a top upwardly facing horizontal surface with a plurality of contact elements for engaging the reticle, the base having a reticle seating position, the base further having a sealing surface extending around the base at or proximate to the periphery of said base;

a cover for engaging the base along the base periphery, thereby defining an interior for holding the reticle, the cover having a sealing surface for cooperating with the sealing surface of the base to create a seal therebetween, the cover further comprising a vertically movable member positioned in an opening extending through the cover, the vertically movable member actuatable from exterior the cover to move the entire vertically movable member vertically relative to the cover for engaging the reticle in the container at the reticle seating position, the container further comprising an outer cover and a door receivable within the outer cover to define an additional container with an interior, the outer cover and door sized to receive the container for holding reticles in the interior.

5. The container of claim 4 wherein the additional container is configured to actuate the vertically movable member when the container is received in the additional container whereby the vertically movable member moves towards the reticle.

6. The container of claim 2 wherein the top upwardly facing planar horizontal surface of the base is metal and the downwardly facing horizontal planar sealing surface is metal.

7. The container of claim 2 wherein the gap between the reticle face and the upwardly facing planar horizontal surface is between 0.003 to 0.007 inches.

8. The container of claim 2 wherein the top upwardly facing planar horizontal surface of the base is a polished metal surface.

9. The container of claim 1 wherein the plurality of vertically movable members are connected to the inner pod cover by way of a plurality of resilient members.